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Memorandum

Date: September 30, 2008
To: Adam Weinstein, LSA Associates
From: Bill Burton, Ryan Niblock
Subject: Benicia Business Park – Supplemental Transportation Assessment

This memorandum has been prepared to summarize our assessment of the revised Project description for the Benicia Business Park Project (herein referred to as the "Project"). The Project site is located in northeast Benicia, east of Interstate 680 (I-680), south of Lake Herman Road, and north of East Second Street. The original Project description analyzed in the Benicia Business Park EIR included approximately 857,000 square feet of commercial space and 4,443,440 square feet of industrial space. The revised Project description would reduce the amount of total industrial space by 46 percent, from 4,443,440 square feet to 2,399,760 square feet. The square footage of commercial space would remain unchanged at 857,000 square feet. Included as part of this assessment are the following:

- A comparison of trip generation for the revised Project description and the original Project description, including new estimates for weekday Midday peak hour conditions;
- A re-evaluation of potential impacts to study intersections during the AM and PM peak hours (using new traffic counts at six locations), an evaluation of potential traffic congestion problems at four new study intersections during the AM and PM peak hours, and an evaluation of potential traffic congestion problems at six study intersections during the weekday Midday peak hour;
- A re-evaluation of potential impacts to freeway mainline segments; and
- The identification of appropriate Transportation Demand Management (TDM) measures to further reduce the number of vehicle trips generated by the Project.

It should be noted that the analysis of weekday Midday peak hour conditions is done in response to concerns expressed at the June 2008 City Council Meeting to determine whether lunch time trips associated with the proposed Project would create traffic congestion problems. Based on input from City of Benicia staff members, intersections along East 2nd Street and along Military East Street were selected for review, as intersections along these roadways would be the most likely to be affected by Project Midday peak hour trips.

The results of this assessment show that the revised Project's effect on traffic operations within the City of Benicia would be diminished as compared to the original Project description. Potentially significant impacts at the East 2nd Street / Rose Drive and the Park Road / Industrial Way intersections would no longer occur, and the potentially significant impact on I-780 would no longer occur. In addition, the magnitude of several remaining mitigation measures would be reduced substantially. New improvement measures have been identified at the East 2nd Street / Military East Street intersection to address traffic congestion problems during the Midday peak hour. New improvement measures have also been identified at the East 2nd Street / East Seaview Drive study intersection to address traffic congestion problems during the AM, PM, and Midday peak hours.

Project Trip Generation

Methodology

Trip generation estimates for the revised Project were made by applying the same methodology used in the Benicia Business Park EIR, using data provided in the Institute of Transportation Engineers' (ITE) *Trip Generation, 7th Edition* (2003). A summary of the ITE Land Use codes assumed for each Project land use is provided in Table 1.

Table 1: Land Use Assumptions

Land Use Type	Amount	Unit	Corresponding ITE Land Use (Code)
Hotel/CC	105	Employees	Hotel (310)
3-story Hotel	87	Employees	Hotel (310)
Fitness Club	60	KSF	Health/Fitness Club (492)
Office (4 Story)	200	KSF	General Office Building (710)
Movie	60	KSF	Movie Theatre with Matinee (444)
Office (2 Story)	100	KSF	General Office Building (710)
Retail	100	KSF	Specialty Retail (814)
Restaurant	20	KSF	High-Turnover (Sit-Down) Restaurant (932)
Fast Food	8	KSF	Fast-Food Restaurant with Drive-Through Window (934)
Gas Station	7	KSF	Gasoline/Service Station with Convenience Market (945)
Bank	12	KSF	Drive-in Bank (912)
R&D	50	KSF	Research and Development Center (760)
Tilt-up	1,091	KSF	Warehousing (150)
Flex Use	1,308	KSF	Business Park (770)

Source: ITE, *Trip Generation*, 7th Edition, 2004.

Though specific Midday trip generation rates are not typically provided, information regarding hourly variations in retail trips and general work trips are available through ITE's *Trip Generation*, and through ITE's *Transportation and Land Development* references. By applying the relationships between Midday and PM peak hour travel characteristics presented in these two sources to the PM peak hour trip generation rates assumed for the proposed Project, Midday trip generation can be calculated.

Since the site plan provided for the revised Project has been developed to a level of detail such that internally linked trips and pass-by trips can be calculated, appropriate trip generation reductions to account for these characteristics have been taken. Chapters Five and Seven of the Institute of Transportation Engineers' *Trip Generation Handbook* (2001) provide data regarding the internally linked and pass-by trip characteristics of mixed-use developments. Internally linked trips refer to a single trip made to more than one Project land use (e.g., an outbound trip from an office use may stop at one of the retail uses before exiting the Project area altogether). Pass-by trips refer to traffic whose origin and destination are unrelated to the Project, but stop at one of the Project's retail uses (e.g., a commuter along I-680 stopping at the proposed gas station).

Trip Generation Comparison

The revised Project trip generation, applying all appropriate adjustments, is summarized in Table 2. As shown, the revised Project would result in 29,190 fewer average daily trips (from 69,017 to 39,827), 2,735 fewer trips during the AM peak hour (from 6,246 to 3,511), 1,669 fewer trips during the Midday peak hour (from 3,876 to 2,207), and 2,874 fewer trips during the PM peak hour (from 6,942 to 4,068).

Table 2: Trip Generation Comparison

Land Use	Size	Unit	ADT	AM Peak Hour			MID Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total	In	Out	Total
Raw Trip Generation:												
Hotel/CC	105	Emp.	1,506	43	29	72	30	32	62	45	39	84
3-story Hotel	87	Emp.	1,248	36	24	60	25	27	52	38	32	70
Fitness Club	60	KSF	1,578	31	42	73	87	93	180	124	119	243
Office (4 Story)	200	KSF	2,202	273	37	310	69	69	138	51	247	298
Movie	60	KSF	2,280	-	-	-	84	21	105	91	137	228
Office (2 Story)	100	KSF	1,101	136	19	155	35	35	69	25	124	149
Retail	100	KSF	4,432	-	-	-	97	104	201	119	152	271
Restaurant	20	KSF	2,543	120	110	230	78	84	162	133	85	218
Fast Food	8	KSF	3,969	217	208	425	99	107	206	144	133	277
Gas Station	7	KSF	6,092	277	267	544	241	260	500	338	338	675
Bank	12	KSF	2,958	83	65	148	196	211	407	275	275	549
R&D	50	KSF	406	51	11	62	13	13	25	8	46	54
Tilt-up	1,091	KSF	4,366	267	186	453	100	100	199	34	397	431
Flex Use	1,308	KSF	16,695	1,572	299	1,871	390	390	780	388	1,300	1,688
<i>Raw Trip Generation Subtotal</i>			<i>51,375</i>	<i>3,106</i>	<i>1,297</i>	<i>4,403</i>	<i>1,541</i>	<i>1,545</i>	<i>3,086</i>	<i>1,813</i>	<i>3,422</i>	<i>5,235</i>
Internally Linked and Pass-By Trip Reductions:												
Retail Internal Trips			-1,312	-43	-45	-88	-55	-46	-101	-62	-63	-125
Office/Industrial Internal Trips			-372	-21	-17	-38	-26	-35	-61	-37	-26	-63
Hotel Internal Trips			-1,157	-26	-28	-54	-20	-20	-40	-28	-38	-66
General Retail Pass-By Trips			-638	-0	-0	-0	-14	-15	-29	-17	-22	-39
Restaurant Pass-By Trips			-1,081	-51	-47	-98	-33	-36	-69	-57	-36	-93
Fast-Food Pass-By Trips			-1,984	-107	-102	-209	-49	-54	-103	-72	-67	-139
Gas Station Pass-By Trips			-3,604	-171	-164	-335	-136	-147	-283	-191	-191	-382
Drive-in Bank Pass-By Trips			-1,400	-39	-31	-70	-93	-100	-193	-130	-130	-260
<i>Reduction Subtotal</i>			<i>-11,548</i>	<i>-458</i>	<i>-434</i>	<i>-892</i>	<i>-426</i>	<i>-453</i>	<i>-879</i>	<i>-594</i>	<i>-573</i>	<i>-1,167</i>
Revised Project Trip Generation Summary:												
Raw Trip Generation Subtotal			51,375	3,106	1,297	4,403	1,541	1,545	3,086	1,813	3,422	5,235
Reduction Subtotal			-11,548	-458	-434	-892	-426	-453	-879	-594	-573	-1,167
Net Trip Generation Total			39,827	2,648	863	3,511	1,115	1,092	2,207	1,219	2,849	4,068
Trip Generation Difference from Original Project Description:												
Original Project Total			69,017	4,592	1,654	6,246	1,936	1,940	3,876	2,165	4,777	6,942
Revised Project Total			39,827	2,648	863	3,511	1,115	1,092	2,207	1,219	2,849	4,068
Difference			-29,190	-1,944	-791	-2,735	-821	-848	-1,669	-946	-1,928	-2,874

Source: DMJM Harris, 2008.

Notes: Emp. = Employees, KSF = 1,000 square feet, ADT = average daily trips

It should be noted that along East 2nd Street, the original Project would add 2,342 trips (1,722 northbound and 620 southbound) during the AM peak hour, 1,932 trips (965 northbound and 967 southbound) during the Midday peak hour, and 2,603 trips (812 northbound and 1,791 southbound) during the PM peak hour. Under the revised Project description, these totals would be reduced substantially. The revised Project would add 1,317 trips along East 2nd Street during the AM peak hour (a reduction of 1,025 trips), 1,101 trips during the Midday peak hour (a reduction of 831 trips), and 1,526 trips during the PM peak hour (a reduction of 1,077 trips).

Trip Distribution Pattern

For AM and PM peak hour trip generation, the trip distribution pattern presented in the EIR remains applicable for the revised Project description. For the Midday peak hour, adjustments to the pattern presented in the EIR are made to account for lunch trips destined for downtown Benicia and other area retail opportunities. Using Solano County Model output files for non-work trips, the destination for lunch

trips from the Project area can be determined. The adjusted Midday peak hour trip distribution pattern is presented in Figure 1.

Re-Evaluation of Project Impacts

Intersection Impacts

The re-evaluation of intersection impacts is done at all 20 intersections previously studied in the Benicia Business Park EIR. An evaluation of potential traffic congestion problems is done at four new study intersections. Per the request of City of Benicia staff, new AM and PM peak hour traffic counts were collected at five of the previously studied intersections, and new Midday peak hour traffic counts were collected at two of the previously studied intersections. The traffic counts collected for these previously studied intersections were collected simultaneously with the traffic counts collected for the four new study intersections on August 27 and 28, 2008. For the remaining study intersections, traffic counts from the Benicia Business Park EIR were used. All intersections studied as part of this supplemental transportation assessment are listed below, with intersections using new traffic counts and intersections selected for Midday peak hour analysis noted.

1. East Second Street / Park Road / New Access;
2. East Second Street / Industrial Way (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis);
3. East Second Street / Rose Drive (new AM and PM peak hour traffic counts);
4. East Second Street / I-780 Westbound Ramps (new AM and PM peak hour traffic counts);
5. East Second Street / I-780 Eastbound Ramps (new AM and PM peak hour traffic counts);
6. East Second Street / Military East Street (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis);
7. Lake Herman Road / Columbus Parkway;
8. Lake Herman Road / Reservoir Road;
9. Lake Herman Road / East Second Street;
10. Lake Herman Road / I-680 Southbound Ramps;
11. Lake Herman Road / I-680 Northbound Ramps /Goodyear Road;
12. Lake Herman Road / Industrial Way;
13. Park Road / Industrial Way;
14. Industrial Way / I-680 Southbound Ramps;
15. Industrial Way / I-680 Northbound Ramps;
16. Park Road / Bayshore Road;
17. Bayshore Road / I-680 Southbound Ramps;
18. Bayshore Road / I-680 Northbound Ramps;
19. Columbus Parkway / Rose Drive;
20. Columbus Parkway / Admiral Callaghan Drive;
21. East Second Street / East Seaview Drive (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis);
22. East Second Street / Hillcrest Avenue (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis);
23. East Second Street / Riverhill Drive (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis); and
24. First Street / Military East Street / Military West Street (new AM and PM peak hour traffic counts, selected for Midday peak hour analysis).



Midday trip distribution.ai

BENICIA BUSINESS PARK

Figure 1
PROJECT TRIP DISTRIBUTION
Midday Peak Hour

It should be noted that the new traffic count collection date (August 27, 2008) was declared a “Spare the Air” day by the Bay Area Air Quality Management District (BAAQMD). Typically, the BAAQMD declares “Spare the Air” days with a few days’ notice. However, since traffic counts must be ordered weeks in advance, the traffic count date could not be adjusted. For the purposes of comparison, additional spot counts were collected on a non-“Spare the Air” day (September 18, 2008). A direct comparison of these traffic volumes during AM, PM, and Midday peak hours (presented in Table 3) actually showed higher volumes during the August traffic count; however, the overall differences in total volumes were relatively minor. As such, for the purposes of providing a conservative analysis of potential Project impacts, the traffic counts collected in August were used.

Table 3: “Spare the Air” Volume Comparison

Intersection	Peak Hour	Total Intersection Volume		Volume Difference	Percentage Difference
		8/27/08 Traffic Count	9/18/08 Traffic Count		
East 2nd Street / Military East Street	AM	1,476	1,299	-177	-12.0%
	MID	1,767	1,596	-171	-9.7%
	PM	2,019	1,816	-203	-10.1%
East 2nd Street / Hillcrest Avenue	AM	1,590	1,531	-59	-3.7%
	MID	1,129	1,104	-25	-2.2%
	PM	1,482	1,429	-53	-3.6%

Source: DMJM Harris, 2008.

Notes: MTC declared August 27, 2008 a “Spare the Air” day after traffic counts had been initiated.

Existing plus Project

Levels of Service (LOS) at all study intersections are evaluated using the revised Project description. Updated intersection LOS for the Existing plus Project Condition are summarized in Table 4.

Table 4: Existing Plus Project Intersection Level of Service Comparison

No.	Intersection	Peak Hour	Existing Conditions		Existing plus Original Project		Existing plus Revised Project		Existing plus Revised Project (Mitigated)	
			LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1	East 2nd Street / Park Road / New Access	AM	B	10.7	F	>80.0	F	>80.0	A	7.2
		PM	B	12.1	F	>80.0	F	>80.0	B	14.5
2	East 2nd Street / Industrial Way	AM	A	9.8	F	>80.0	D	46.9	C	22.1
		MID	B	12.8	F	>80.0	C	20.2	C	22.4
		PM	B	10.8	F	>80.0	F	>80.0	C	21.0
3	East 2nd Street / Rose Drive	AM	A	9.9	B	17.5	B	10.2	N/A	N/A
		PM	B	10.2	F	>80.0	C	20.2	N/A	N/A
4	East 2nd Street / I-780 WB Ramps	AM	C	20.8	F	>80.0	F	>80.0	C	21.3
		PM	C	22.4	D	41.9	C	23.9	C	26.6
5	East 2nd Street / I-780 EB Ramps	AM	B	15.0	F	>80.0	F	>80.0	A	6.9
		PM	B	13.9	F	>80.0	E	61.7	A	9.0
6	East 2nd Street / Military East Street ⁽¹⁾	AM	C	21.3	C	22.1	C	21.7	----	----
		MID	C	21.8	F	>80.0	F	>80.0	----	----
		PM	C	24.0	C	25.0	C	24.6	----	----
7	Lake Herman Road / Columbus Parkway	AM	B	11.2	D	39.9	B	19.1	----	----
		PM	B	12.0	C	24.0	C	20.6	----	----
8	Lake Herman Road /	AM	A	9.8	C	21.0	B	13.0	A	6.3

	Industrial Way extension ⁽²⁾	PM	B	10.2	F	>50.0	E	45.2	B	12.8
9	Lake Herman Road / East 2nd Street	AM	D	26.0	F	>50.0	F	>50.0	B	10.5
		PM	B	11.6	F	>50.0	F	>50.0	B	17.9
10	Lake Herman Road / I-680 Southbound Ramps	AM	B	13.5	F	>50.0	F	>50.0	B	16.0
		PM	B	13.7	F	>50.0	F	>50.0	A	8.5
11	Lake Herman Road / I-680 NB Ramps / Goodyear Road	AM	B	10.7	F	>50.0	F	>50.0	B	16.5
		PM	B	10.8	F	>50.0	F	>50.0	B	16.6
12	Lake Herman Road / Industrial Way	AM	B	10.1	B	10.1	B	10.1	----	----
		PM	B	10.8	B	10.8	B	10.8	----	----
13	Park Road / Industrial Way	AM	B	11.7	D	25.1	C	15.9	----	----
		PM	B	12.3	C	24.4	C	17.1	----	----
14	Industrial Way / I-680 SB Ramps	AM	A	9.7	B	10.4	A	10.0	----	----
		PM	B	11.0	B	11.1	B	11.0	----	----
15	Industrial Way / I-680 NB Ramps	AM	B	11.3	B	12.1	B	11.7	----	----
		PM	B	14.0	C	18.1	C	16.2	----	----
16	Park Road / Bayshore Road	AM	B	13.1	D	35.0	C	19.6	N/A	N/A
		PM	B	14.6	F	>50.0	D	33.4	N/A	N/A
17	Bayshore Road / I-680 SB Ramps	AM	A	7.9	A	8.1	A	8.0	----	----
		PM	A	8.6	A	9.6	A	9.2	----	----
18	Bayshore Road / I-680 NB Ramps	AM	B	11.2	C	15.8	B	13.2	----	----
		PM	A	9.7	B	10.6	B	10.2	----	----
19	Columbus Parkway / Rose Drive	AM	B	13.4	B	12.1	B	12.6	----	----
		PM	B	13.8	B	11.4	B	11.9	----	----
20	Columbus Parkway / Admiral Callaghan Drive	AM	A	5.7	A	3.8	A	4.0	----	----
		PM	A	9.8	A	9.0	A	9.7	----	----
21	East 2nd Street / East Seaview Drive	AM	D	31.3	F	>50.0	F	>50.0	----	----
		MID	B	12.8	F	>50.0	D	30.6	----	----
		PM	D	28.5	F	>50.0	F	>50.0	----	----
22	East 2nd Street / Hillcrest Avenue	AM	B	12.2	E	64.8	B	16.5	----	----
		MID	A	7.3	A	9.1	A	7.7	----	----
		PM	B	10.4	D	42.4	B	13.5	----	----
23	East 2nd Street / Riverhill Drive	AM	F	>50.0	F	>50.0	F	>50.0	----	----
		MID	D	31.7	F	>50.0	F	>50.0	----	----
		PM	E	43.8	F	>50.0	E	47.8	----	----
24	1st Street / Military East Street / Military West Street	AM	B	17.8	B	17.8	B	17.8	----	----
		MID	B	19.1	D	45.4	C	23.9	----	----
		PM	C	21.3	C	21.3	C	21.3	----	----

Source: DMJM Harris, 2008.

Notes: **Bolding** indicates unsatisfactory level of service.

LOS = Level of Service, OWSC = One-Way Stop Controlled, TWSC = Two-Way Stop Controlled, AWSC = All-Way Stop Controlled.

⁽¹⁾ Since the time of the original analysis, the signal phasing of this intersection has been adjusted to include a southbound right-turn overlap phase, resulting in delays at the southbound approach to the intersection decreasing.

⁽²⁾ The proposed Project includes the removal of Reservoir Road and completion of the Industrial Way extension to Lake Herman Road.

As shown, average delay at select study intersections was found to be lower under the revised Project description, in some cases by a substantial amount. At the East 2nd Street / Rose Drive intersection, the Project would no longer cause the level of service to degrade to unacceptable levels. As a result, Impact TRANS-3 and Mitigation Measure TRANS-3 which were previously identified in the EIR would no longer apply.

At the East 2nd Street / Military East Street intersection, the addition of Project traffic (under either Project description) would cause the intersection to deteriorate from LOS C to LOS F during the Midday peak hour. As such, the Project would need to install the improvements listed in Table 10 to improve future conditions to LOS D or better. At the East 2nd Street / East Seaview Drive intersection, the addition of Project traffic (under either Project description) would cause the worst minor approach to the intersection to deteriorate from LOS D to LOS F. The MUTCD Peak Hour Volume Warrant would be met during the AM peak hour, and so a new traffic signal could address side street delays. However, since the East 2nd Street / East Seaview Drive intersection is spaced approximately 300 feet from the nearest traffic signal at the East 2nd Street / Hillcrest Avenue intersection, a new signal may negatively affect East 2nd Street corridor operations. Thus, in lieu of installing a new traffic signal, other improvement measures such as left-turn restrictions should be installed to address side street delays while maintaining the efficiency of the East 2nd Street corridor as shown in Table 10.

At the East 2nd Street / Hillcrest Avenue intersection the addition of Project generated traffic would cause the level of service to degrade to an unacceptable LOS E under the original Project description only during the AM peak hour. Under the revised Project description, the level of service would remain at an acceptable LOS B or better under Existing plus Project Conditions. The addition of traffic generated by the Project would cause the East 2nd Street / Riverhill Drive intersection to operate at unacceptable conditions under either Project description. However, MUTCD Peak Hour Volume Warrants would not be met, and the Project would add no traffic to the intersection's critical movements.

Cumulative plus Project

The methodology used to develop Cumulative Conditions in the Benicia Business Park EIR is applied to the intersections using new traffic counts in order to develop new Cumulative traffic volumes. Updated intersection LOS for the Cumulative plus Project Condition are summarized in Table 5.

Table 5: Cumulative Plus Project Intersection Level of Service Comparison

No.	Intersection	Peak Hour	Cumulative Conditions		Cumulative plus Original Project		Cumulative plus Revised Project		Cumulative plus Revised Project (Mitigated)	
			LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1	East 2nd Street / Park Road / New Access	AM	B	11.6	F	>50.0	F	>50.0	B	11.2
		PM	B	13.6	F	>50.0	F	>50.0	B	15.0
2	East 2nd Street / Industrial Way	AM	B	10.7	F	>80.0	E	62.0	C	27.8
		MID	B	13.3	F	>80.0	C	22.8	B	16.2
		PM	B	12.0	F	>80.0	F	>80.0	C	24.1
3	East 2nd Street / Rose Drive	AM	B	13.2	C	34.9	B	14.6	N/A	N/A
		PM	B	14.5	F	>80.0	D	41.6	N/A	N/A
4	East 2nd Street / I-780 WB Ramps	AM	C	32.3	F	>80.0	F	>80.0	C	29.4
		PM	D	35.9	F	>80.0	D	42.9	C	34.9
5	East 2nd Street / I-780 EB Ramps	AM	E	77.5	F	>80.0	F	>80.0	B	12.3
		PM	E	57.6	F	>80.0	F	>80.0	B	16.7
6	East 2nd Street / Military East Street ⁽¹⁾	AM	C	32.5	D	35.2	C	33.9	----	----
		MID	D	37.8	F	>80.0	F	>80.0	----	----
		PM	E	59.1	E	67.7	E	64.0	----	----
7	Lake Herman Road / Columbus Parkway	AM	B	13.2	D	41.3	C	20.3	----	----
		PM	B	12.0	B	19.7	B	16.5	----	----
8	Lake Herman Road /	AM	B	10.2	C	21.0	B	13.5	A	6.0

	Industrial Way extension ⁽²⁾	PM	B	10.9	F	>50.0	F	>50.0	B	12.8
9	Lake Herman Road / East 2nd Street	AM	F	>50.0	F	>50.0	F	>50.0	B	11.9
		PM	C	15.8	F	>50.0	F	>50.0	B	17.3
10	Lake Herman Road / I-680 Southbound Ramps	AM	C	18.7	F	>50.0	F	>50.0	B	17.6
		PM	C	22.3	F	>50.0	F	>50.0	A	10.0
11	Lake Herman Road / I-680 NB Ramps / Goodyear Road	AM	B	13.3	F	>50.0	F	>50.0	B	17.2
		PM	B	13.8	F	>50.0	F	>50.0	B	16.6
12	Lake Herman Road / Industrial Way	AM	B	10.8	B	10.8	B	10.8	----	----
		PM	B	12.1	B	12.1	B	12.1	----	----
13	Park Road / Industrial Way	AM	C	15.2	E	37.3	C	22.1	----	----
		PM	C	16.8	E	39.9	D	25.6	----	----
14	Industrial Way / I-680 SB Ramps	AM	B	10.2	B	11.0	B	10.6	----	----
		PM	B	12.2	B	12.3	B	12.2	----	----
15	Industrial Way / I-680 NB Ramps	AM	B	13.1	B	14.2	B	13.6	----	----
		PM	C	19.3	D	28.7	C	24.0	----	----
16	Park Road / Bayshore Road	AM	C	19.0	F	>50.0	E	35.7	B	16.1
		PM	C	24.4	F	>50.0	F	>50.0	B	11.7
17	Bayshore Road / I-680 SB Ramps	AM	A	8.2	A	8.4	A	8.3	----	----
		PM	A	9.2	B	10.2	A	9.8	----	----
18	Bayshore Road / I-680 NB Ramps	AM	B	12.7	C	19.6	C	15.6	----	----
		PM	B	10.1	B	11.1	B	10.7	----	----
19	Columbus Parkway / Rose Drive	AM	B	14.0	B	14.9	B	14.0	----	----
		PM	B	14.4	B	14.3	B	13.6	----	----
20	Columbus Parkway / Admiral Callaghan Drive	AM	A	6.0	A	4.1	A	4.5	----	----
		PM	B	10.5	B	10.5	B	10.3	----	----
21	East 2nd Street / East Seaview Drive	AM	F	>50.0	F	>50.0	F	>50.0	----	----
		MID	C	16.5	F	>50.0	F	>50.0	----	----
		PM	F	>50.0	F	>50.0	F	>50.0	----	----
22	East 2nd Street / Hillcrest Avenue	AM	B	13.7	F	>80.0	C	27.7	----	----
		MID	A	7.8	B	10.7	A	8.5	----	----
		PM	B	11.3	E	78.5	C	20.4	----	----
23	East 2nd Street / Riverhill Drive	AM	F	>50.0	F	>50.0	F	>50.0	----	----
		MID	F	>50.0	F	>50.0	F	>50.0	----	----
		PM	F	>50.0	F	>50.0	F	>50.0	----	----
24	1st Street / Military East Street / Military West Street	AM	B	18.7	B	18.8	B	18.7	----	----
		MID	C	21.9	F	>80.0	D	38.1	----	----
		PM	D	36.7	D	37.3	D	37.1	----	----

Source: DMJM Harris, 2008.

Notes: **Bolding** indicates unsatisfactory level of service.

LOS = Level of Service, OWSC = One-Way Stop Controlled, TWSC = Two-Way Stop Controlled, AWSC = All-Way Stop Controlled.

⁽¹⁾ Since the time of the original analysis, the signal phasing of this intersection has been adjusted to include a southbound right-turn overlap phase, resulting in delays at the southbound approach to the intersection decreasing.

⁽²⁾ The proposed Project includes the removal of Reservoir Road and completion of the Industrial Way extension to Lake Herman Road.

As shown, average delay at select study intersections was found to be lower under the revised Project description, in some cases by a substantial amount. At the East 2nd Street / Rose Drive and the Park Road / Industrial Way intersections, the revised Project would not cause the level of service to degrade to unacceptable levels. As a result, Impacts TRANS-13 and TRANS-20, and Mitigation Measures TRANS-13 and TRANS-20 which were previously identified in the EIR would no longer apply.

At the East 2nd Street / Military East Street intersection, the addition of Project traffic (under either Project description) would cause the intersection to deteriorate from LOS D to LOS F during the Midday peak hour. As such, the Project would need to install the improvements listed in Table 10 to improve future operations to LOS D or better. With or without the addition of Project traffic, the East 2nd Street / East Seaview Drive intersection would operate at LOS F. The MUTCD Peak Hour Volume Warrant would be met during the AM peak hour, and so a new traffic signal could address side street delays. However, since the East 2nd Street / East Seaview Drive intersection is spaced approximately 300 feet from the nearest traffic signal at the East 2nd Street / Hillcrest Avenue intersection, a new signal may negatively affect East 2nd Street corridor operations. Thus, in lieu of installing a new traffic signal, other improvement measures such as left-turn restrictions should be installed to address side street delays while maintaining the efficiency of the East 2nd Street corridor as shown in Table 10.

At the 1st Street / Military East Street / Military West Street and East 2nd Street / Hillcrest Avenue intersections, the addition of Project generated traffic would cause the level of service to degrade to unacceptable levels under the original Project description only. Under the revised Project description, the level of service would remain at LOS D or better under Cumulative plus Project Conditions. The addition of traffic generated by the Project would cause the East 2nd Street / Riverhill Drive intersection to operate at unacceptable conditions under either Project description. However, MUTCD Peak Hour Volume Warrants would not be met, and the Project would add no traffic to the intersection’s critical movements.

Freeway Mainline Segment Impacts

Potential freeway mainline segment impacts along Interstate 780 (I-780) expected to result from the proposed Project were re-evaluated for the revised Project by applying the same methodology used in the Benicia Business Park EIR. Regional freeway data were taken directly from the Solano County Travel Demand Forecast Model, modified to include revised Project land uses. Updated freeway levels of service are summarized in Table 6.

Table 6: Cumulative Plus Project Freeway Level of Service Comparison – PM Peak Hour

Freeway Segment	Planned Lanes	Original Project Description			Revised Project Description		
		Vol	V/C Ratio	LOS	Vol	V/C Ratio	LOS
Westbound I-780 Benicia Bridge to East Second Street	2	3,181	0.723	C	3,181	0.723	C
Westbound I-780 West of East Second Street	2	4,527	1.029	F	4,329	0.984	E
Eastbound I-780 West of East Second Street	2	3,924	0.892	D	3,834	0.871	D
Eastbound I-780 East Second Street to Benicia Bridge	2	4,184	0.951	E	4,184	0.951	E

Source: STA Travel Demand Model; DMJM Harris, 2008.

Notes: Analysis assumes a freeway capacity of 2,200 vehicles/lane/hour for 2-lane segments.
 LOS = Level of Service

As shown, under the revised Project description, traffic volumes at the westbound I-780 segment west of East Second Street are expected to decrease compared to the earlier Project. As a result, the Project would no longer create a potentially significant impact at this location.

Pedestrian Conditions / Robert Semple Elementary School Evaluation

Robert Semple Elementary School is bounded by East 2nd Street, Hillcrest Avenue, East 3rd Street, and East S Street. The school’s main entrance, parking area, and pick-up / drop-off area are all located on East 3rd Street, away from the relatively heavier traffic levels on East 2nd Street. The primary crossing location for students crossing East 2nd Street is at the East 2nd Street / Hillcrest Avenue intersection, where crossing guards are situated to assist students before and after school. This intersection is signalized, includes pedestrian heads, provides sidewalks at all approaches, and has standard crosswalks at the intersection’s south, east, and west legs. During field observations, students were observed crossing during designated times, and no conflicts between pedestrians and motorists were observed.

Historical collision data collected from 2005 to 2007 was examined along East 2nd Street between Tennys Drive and Riverhill Drive. All collisions involving vehicles, bicycles, and pedestrians were noted, along with their primary causal factors. Table 7 summarizes all collisions by location and type, and Table 8 summarizes the primary causal factors of each incident.

Table 7: East 2nd Street Collision Summary (from Tennys Drive to Riverhill Drive, 2005-2007)

No.	Intersection	Collision Involving				Total	Injuries
		Vehicle	Bicycle	Pedestrian	Other		
4/5	East 2nd Street / I-780 Ramps	19	0	0	0	19	10
22	East 2nd Street / Hillcrest Avenue	0	0	0	0	0	0
23	East 2nd Street / Riverhill Drive	3	0	1	0	4	2
--	Other locations on East 2nd Street between Hillcrest Avenue and Riverhill Drive	10	0	0	0	10	4
--	Total	32	0	1	0	33	16

Source: California Highway Patrol, *Statewide Integrated Traffic Records System*, 2007.

Table 8: East 2nd Street Collision Primary Causal Summary (from Tenny's Drive to Riverhill Drive, 2005-2007)

No.	Intersection	Fail to Yield to Vehicle	Unsafe Speed	DUI	Unsafe Lane Change	Unknown / Other / Not Stated
4/5	East 2nd Street / I-780 Ramps	5%	58%	11%	11%	15% ⁽¹⁾
22	East 2nd Street / Hillcrest Avenue	0%	0%	0%	0%	0%
23	East 2nd Street / Riverhill Drive	33%	33%	0%	0%	34% ⁽²⁾
--	Other locations on East 2nd Street between Hillcrest Avenue and Riverhill Drive	80%	20%	0%	0%	0%

Source: California Highway Patrol, *Statewide Integrated Traffic Records System*, 2007.

Notes: ⁽¹⁾ 10% fail to stop; 5% back into stopped vehicle.

⁽²⁾ 34% fail to yield to pedestrian.

As shown, the majority of collisions recorded tended to occur near the I-780 on- and off-ramps. Of the 33 total collisions recorded, only one involved a pedestrian at the East 2nd Street / Riverhill Drive intersection. No collisions of any kind were recorded at the East 2nd Street / Hillcrest Avenue intersection, which is the primary crossing location for students of Robert Semple Elementary School. Though no collisions were found to occur at this location, the City of Benicia may consider the implementation of traffic calming measures along the East 2nd Street corridor as a condition of approval for the Project, since the Project would add as much as 1,317 new vehicle trips along East 2nd Street during the AM peak hour, 1,101 during the Midday peak hour, and 1,526 during the PM peak hour. The following traffic calming measures should be considered for implementation:

- **Install high-visibility crosswalks at East 2nd Street / Hillcrest Avenue.** Currently, standard crosswalks are provided at the south, east, and west legs of the intersection. The installation of high-visibility crosswalks would allow drivers to identify the crosswalks from a further distance with longer reaction time; reducing the potential for conflicts between pedestrians and automobiles.
- **Install Radar Speed Feedback Sign.** Coupled with school-zone signage, a Radar Speed Feedback Sign could be installed to alert drivers of their speed as they approach a school zone.
- **Install Flashing Yellow Lights.** Enhanced flashing school crossing warning signs allow drivers to prepare to slow down before entering a slower speed zone.
- **Ensure the presence of crossing guards at East 2nd Street / Hillcrest Avenue.** Currently, crossing guards are stationed at the East 2nd Street / Hillcrest Avenue intersection before and after school sessions. It is recommended that these crossing guards remain at the intersection after the implementation of the proposed Project.
- **Implement on-street traffic calming devices.** To have a direct effect on vehicles travelling along East 2nd Street, an on-street traffic calming device should be implemented. Such traffic calming devices should include landscaped median islands, striping and/or pavement marking changes, or different colored bicycle lanes. Each device would raise driver awareness of surrounding conditions, while slowing vehicles down.

Mitigation Measures

In addition to impacts to two intersections and one freeway segment that would no longer occur as a result of the reduced trip generation associated with the revised Project description, the magnitude of several other impacts would also be reduced. The improvements required to mitigate all impacts caused by the revised Project description are summarized in Table 9. At locations where traffic congestion problems would occur as a result of Project traffic, improvement measures are proposed as conditions of approval for the Project. Descriptions of the proposed improvement measures, and their effects on intersection levels of service are summarized in Table 10.

Table 9: Updated Mitigation Measures for Revised Project Description

Revised Project Description Related Impacts	Mitigation Measures	Significance After Mitigation
Intersection Impacts:		
Unacceptable LOS at the intersection of East 2nd Street / Park Road / New Access (Impact TRANS-1 and Impact TRANS-11).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize intersection: this intersection meets Signal Warrant 11, Peak Hour Volumes for both the AM and PM peak hours. Reconfigure SB approach to provide one exclusive left-turn lane and one through-right lane. Reconfigure EB approach to provide one exclusive left-turn lane and one through-right lane. Reconfigure WB approach to provide one shared through-left lane, and one exclusive right-turn lane.</p>	Less Than Significant
Unacceptable LOS at the intersection of East 2nd Street / Industrial Way (Impact TRANS-2 and Impact TRANS-12).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Reconfigure WB approach to provide one exclusive left-turn lane, two through lanes, and one exclusive right-turn lane. Overlap the SB right-turn movement with the protected EB left-turn movement.</p>	Less Than Significant
Unacceptable LOS at the intersection of East 2nd Street / 1-780 Westbound Ramps (Impact TRANS-4 and Impact TRANS-14).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Reconfigure NB approach to provide one exclusive left-turn lane, one through lane, and one through-right lane.</p>	Less Than Significant
Unacceptable LOS at the intersection of East 2nd Street / 1-780 Eastbound Ramps (Impact TRANS-5 and Impact TRANS-15).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Reconfigure WB approach to provide one shared left-right lane, and one free right-turn lane.</p>	Less Than Significant
Unacceptable LOS at the intersection of Lake Herman Road / extension of Industrial Way (Impact TRANS-6 and Impact TRANS-16).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize intersection: this intersection meets Signal Warrant 11, Peak Hour Volumes for both the AM and PM peak hours.</p>	Less Than Significant
Unacceptable LOS at the intersection of Lake Herman Road / East 2nd Street (Impact TRANS-7 and Impact TRANS-17).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize intersection as it meets Signal Warrant 11, Peak Hour Volumes for the AM and PM peak hours. Reconfigure the EB approach to provide one exclusive left-turn lane and one through-right</p>	Less Than Significant

	lane. Reconfigure the WB approach to provide two exclusive left-turn lanes and one through-right lane. Protect the EB and WB left-turn movements. Reconfigure the NB approach to provide one shared through-left lane, and two right-turn lanes. Overlap the two NB right-turn lanes with the WB left-turn movement.	
Unacceptable LOS at the intersection of Lake Herman Road / I-680 Southbound Ramps (<u>Impact TRANS-8</u> and <u>Impact TRANS-18</u>).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize intersection as it meets Signal Warrant 11, Peak Hour Volumes for the AM and PM peak hours. Widen Lake Herman Road per the discussion on page 171 of the DEIR. Reconfigure WB approach to provide one exclusive left-turn lane, and one through lane. Reconfigure SB approach to include one all-movement lane, and one right-turn lane.</p> <p>This improvement shall be included in a comprehensive plan to improve the operation of I-680 between Industrial Way and Lake Herman Road.</p>	Less Than Significant
Unacceptable LOS at the intersection of Lake Herman Road / I-680 Northbound Ramps / Goodyear Road (<u>Impact TRANS-9</u> and <u>Impact TRANS-19</u>).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize intersection as it meets Signal Warrant 11, Peak Hour Volumes for the AM and PM peak hours.</p> <p>This improvement shall be included in a comprehensive plan to improve the operation of I-680 between Industrial Way and Lake Herman Road.</p>	Less Than Significant
Unacceptable LOS at the intersection of Park Road / Bayshore Road (<u>Impact TRANS-10</u> and <u>Impact TRANS-21</u>).	<p><u>Mitigation Measure:</u> The Project sponsor shall install and pay for the following improvement without Transportation Impact Fee credits.</p> <p>Signalize the intersection. Though the intersection would not meet signal warrants, the only other possible improvements would require extensive widening, including dual left-turns and dual right-turns. Typically, dual turn lanes are not recommended at stop controlled intersections for driver confusion and safety reasons.</p>	Less Than Significant
Freeway Impacts:		
N/A	N/A	N/A
Transit Impacts:		
The Project would be inadequately served by transit facilities (<u>Impact TRANS-23</u>).	<p><u>Mitigation Measure:</u> The Project sponsor shall be responsible for the cost to extend Benicia Transit (Benicia Breeze) to the Project site. Current routes which connect Benicia with Pleasant Hill BART Station, Baylink Ferry Terminal, and other destinations in Solano County do not currently serve the Project site. These costs shall include all capital costs (i.e., buses, transit shelters, and signage) associated with build-out of the Benicia Business Park.</p>	Less Than Significant

Bicycle/Pedestrian Impacts:		
<p>The Project would not include bicycle and pedestrian facilities (<u>Impact TRANS-24</u>).</p>	<p><u>Mitigation Measure:</u> The Project sponsor shall incorporate the following design elements and services into the proposed development plans to minimize potential pedestrian and bicycle facility impacts. Bicycle facilities would be developed along Industrial Way as part of the Project.</p> <ul style="list-style-type: none"> • Pedestrian sidewalks connecting all major buildings and parking areas within the Project site; • Pedestrian routes between cul-de-sacs and adjacent parcels; • Crosswalks at all areas where there may be potential pedestrian/vehicular conflicts; • Bicycle racks at all building entrances; • Incentives for individual buildings to contain showers and lockers, and secure indoor bicycle lockers; • Sidewalks along East 2nd Street, A Street, and Industrial Way; • Sidewalks along Lake Herman Road (between A Street and East 2nd Street); • Class I/II Bikeway along Lake Herman Road (between A Street and I-680); • Class II/III Bikeway along Lake Herman Road (between Industrial Way and A Street); • Class I Bikeway between East 2nd Street and Lake Herman Road in the project site; • Class I Bikeway between Channel Road and East 2nd Street; and • Parking and building leases at the Business Park shall be “unbundled” (i.e., rents for building space and parking lots shall be separate). Businesses at the Business Park that have 50 or more employees and provide employee parking on a free or subsidized basis shall provide financial compensation to those employees who commute by means other than private automobile, in accordance with CA Health and Safety Code 43845. 	<p>Less Than Significant</p>
Construction Period Impacts:		
<p>Temporary transportation impacts would result from truck movements and construction worker vehicles traveling to and from the Project site (<u>Impact TRANS-25</u>).</p>	<p><u>Mitigation Measure:</u> Prior to the issuance of each building permit, the Project sponsor and construction contractor shall meet with the Benicia Public Works Department and other appropriate City of Benicia agencies to determine traffic management strategies to reduce, to the maximum extent feasible, traffic congestion and the effects of parking demand by construction workers during construction of the Project. The Project sponsor shall develop a construction management plan for review and approval by the City Public Works Department. The plan shall include at least the following items and requirements:</p> <ul style="list-style-type: none"> - A set of comprehensive traffic control measures, including scheduling of major truck trips and deliveries to avoid peak traffic hours, provisions for truck queuing, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes. - Identification of any transit stop relocations. 	<p>Less Than Significant</p>

	<ul style="list-style-type: none"> - Provisions for parking management and spaces for all construction workers to ensure that construction workers do not park in on-street spaces. - Identification of parking space removal and any relocation of parking for employees, and public parking during construction. - Notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures will occur. - Provisions for accommodation of pedestrian flow. - No construction traffic shall be allowed on East 2nd Street north of Industrial Way, and on Lake Herman Road and Reservoir Road. - Location of construction staging areas for materials, equipment, and vehicles. - Identification of haul routes for movement of construction vehicles that would minimize impacts on vehicular and pedestrian traffic, circulation and safety; and provisions for monitoring surface streets used for haul routes so that any damage and debris attributable to the haul trucks can be identified and corrected by the Project sponsor. - A process for responding to, and tracking, complaints pertaining to construction activity, including identification of an onsite complaint manager. 	
<p>High volumes of heavily laden trucks have an incremental impact on the condition of streets and highways (Impact TRANS-26).</p>	<p><u>Mitigation Measure:</u> The Project sponsor shall prepare an overall construction traffic management plan to limit the effects of trucks and other construction traffic on surface conditions of area roads and intersections. This plan shall be prepared in coordination with the City of Benicia, and shall include the following provisions:</p> <ul style="list-style-type: none"> - Prior to implementation of the proposed Project, the Project sponsor shall survey the condition of truck access route roadways and prepare an existing conditions report to document roadway baseline conditions. - During the construction of the Project, or periodically throughout the Project's construction period, the Project sponsor shall make periodic improvements to area roadways to maintain minimum standards, including clean- up of construction debris (e.g., sand and gravel) and spot repaving of potholes or other severe pavement section damage. 	<p>Less Than Significant</p>

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	- Upon completion of all or most of Project construction activities, the Project sponsor shall identify any impacts to roadway conditions. The project sponsor will install improvements and/or pay an impact fee to mitigate any damages to the existing street pavements on East 2nd Street, Industrial Way, and Lake Herman Road to/from the Project site caused by heavy construction traffic accessing the Project site, as determined by the City Engineer.	
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Source: DMJM Harris, 2008.

Table 10: New Conditions of Approval for the Proposed Project

No.	Intersection	Peak Hour	Intersection Operations Pre-Improvements				New Conditions of Approval	Intersection Operations Post-Improvements			
			Existing plus Project		Cumulative plus Project			Existing plus Project		Cumulative plus Project	
			LOS	Delay	LOS	Delay		LOS	Delay	LOS	Delay
6	East 2nd Street / Military East Street	AM	C	21.7	C	33.9	<p>New improvements for the East 2nd Street / Military East Street intersection, as approved by the Director of Public Works, are to include reconfiguring the eastbound approach to the intersection to include two left-turn lanes and one shared through-right turn lane. To accommodate these left turn lanes, to north leg of the intersection would need to be widened to create an additional receiving lane. Signal timing and phasing would need to be updated to allow eastbound/westbound split phasing.</p> <p>After implementing these improvements, the intersection would operate at LOS E during the Midday peak hour. To reduce this to LOS D, the number of Project trips passing through the intersection would need to be reduced by way of implementing a Transportation Demand Management Plan, or the southbound right turn movement would need to be converted into a free right turn.</p>	C	31.4	C	34.2
		MID	F	>80.0	F	>80.0		D	38.9	D	54.1
		PM	C	24.6	E	64.0		C	34.2	D	40.1
21	East 2nd Street / East Seaview Drive	AM	F	>50.0	F	>50.0	<p>New improvements for the East 2nd Street / East Seaview Drive intersection, as approved by the Director of Public Works, should include restricting eastbound left turns. Though such a restriction would result in increased U-turns at the East 2nd Street / Hillcrest Avenue intersection, the intersection would continue to operate at acceptable levels of service. Also, it should be noted that though the East 2nd Street / Hillcrest Avenue intersection is the primary crossing location for Robert Semple Elementary School students, the additional U-turning vehicles would all occur at the north leg of the intersection, where pedestrian crossing is currently prohibited.</p> <p>By implementing this measure, the worst minor approach to the intersection would be reduced to LOS E or better under all peak hours. To attain LOS D conditions under all peak hours, the number of Project trips passing through the intersection would need to be reduced by way of implementing a Transportation Demand Management Plan.</p>	C	17.3	D	33.6
		MID	D	30.6	F	>50.0		B	13.5	C	15.5
		PM	F	>50.0	F	>50.0		C	22.9	D	33.3

Source: DMJM Harris, 2008.

Conclusions

Generally, the revised Project description would result in substantially reduced trip generation compared to the original Project. As a result, the Project's effect on traffic operations within the City of Benicia would be diminished somewhat, potentially significant impacts at the East 2nd Street / Rose Drive and the Park Road / Industrial Way intersections would no longer occur, and the potentially significant impact on I-780 would no longer occur. In addition, the magnitude of several remaining mitigation measures would be reduced substantially.

Traffic congestion problems as a result of the addition of Project traffic were identified at the East 2nd Street / Military East Street (Midday peak hour) and the East 2nd Street / East Seaview Drive (AM peak hour) intersections. With the implementation of the proposed improvement measures, these traffic congestion problems can be resolved. To reduce the severity of these traffic congestion problems, and to further reduce the proposed Project's effect on traffic operations within the City of Benicia, the Project should implement a Transportation Demand Management Plan.

Transportation Demand Management

The goal of an effective Transportation Demand Management (TDM) Plan is to reduce the amount of vehicle use (especially single-occupant vehicles) and to encourage employees and visitors to use alternative modes of travel, such as transit, walking, and bicycling. In addition, the TDM Plan should provide means to reduce the demand for travel during peak times.

The TDM Plan would include strategies from the following element categories:

- Parking
- Carpool/vanpool
- Carsharing
- Transit
- Bicycle and pedestrian
- Site design
- Additional strategies and implementation

A comparative cost is associated with each element (LOW, MEDIUM, and HIGH); as is an effectiveness rating (BASIC, MEDIUM, and HIGH) and an indication of cost-effectiveness (FAIR, BETTER, and BEST). Two documents commissioned by the City of Boulder, Colorado, provide the basis for these comparisons: the "TDM Overview" of the Boulder TDM Toolkit and the "TDM Strategies for Implementation" in the City's Transportation Master Plan update. A summary of all applicable TDM elements is provided in Table 11.

The degree to which each element might be expected to shift travel from single-occupant vehicles to other modes is indicated as a percentage in the "Effectiveness" column. These modal shift indicators do not apply to individual elements, but to the element implemented *in conjunction* with related elements of the same effectiveness degree. For an element with a BASIC level of effectiveness to achieve a certain level of modal shift, the element would have to be implemented in conjunction with the other BASIC elements within the category. For an element with a MEDIUM level of effectiveness, implementation of the other MEDIUM as well as the BASIC elements would be necessary. Similarly, the elements with HIGH effectiveness could achieve the modal splits indicated only when implemented along with the MEDIUM and BASIC elements.

Table 11: Potential Transportation Demand Management Elements

Element	Cost	Effectiveness	Cost-Effectiveness
Parking Elements			
<ul style="list-style-type: none"> Where shared parking opportunities exist (e.g., a parking facility provides parking for services uses during the day and a restaurant during the evening), the parking requirements would be reduced accordingly. Preferred parking spaces should be reserved for carpool/vanpool/carshare vehicles. 	Negligible	HIGH – up to 25% modal shift	BEST
Carpool/Vanpool Elements			
<ul style="list-style-type: none"> Vanpool riders should be provided with a one month free trial package. 	Cost-neutral	MEDIUM – up to 12% modal shift	BEST
<ul style="list-style-type: none"> Within the commercial zone, preferential parking spaces should be reserved for carpoolers. 	Negligible	BASIC – up to 5% modal shift	BEST
<ul style="list-style-type: none"> For informal carpooling, a casual carpool pick-up point should be designated. 	Negligible	BASIC – up to 5% modal shift	BEST
<ul style="list-style-type: none"> All employees who are registered carpool/vanpool users should be guaranteed a ride home when carpooling or vanpooling. 	\$25 per employee annually	BASIC – up to 5% modal shift	BEST
<ul style="list-style-type: none"> A carpool/vanpool ride-match program should be established. 	Up to \$30,000	BASIC – up to 5% modal shift	BETTER
Carshare Elements			
<ul style="list-style-type: none"> Long-term contracts with carshare operators should be established to decrease costs. 	Negligible	HIGH – up to 25% modal shift	BETTER
<ul style="list-style-type: none"> Developer should coordinate with carshare providers on reduced fees for long-term carshare use. 			
<ul style="list-style-type: none"> Within the commercial zones, free parking spaces should be reserved for short-term carshare parking. 			
<ul style="list-style-type: none"> All carshare parking spaces and hub locations should be clearly identified and directional signage should be provided. 	Up to \$25,000		
<ul style="list-style-type: none"> Carshare vehicle hubs should be established throughout the site. 	Up to \$70,000		
Transit Elements			
<ul style="list-style-type: none"> A free shuttle should be established to serve the Project site and Downtown Benicia. 	Up to \$500,000 annually	HIGH – up to 15% modal shift*	BEST
<ul style="list-style-type: none"> On-site transit centers should be constructed. These sites should act as service hubs and house TDM information, shelters and kiosks. The kiosks should provide transit maps, schedules, fare, and other rider information. 	MEDIUM – depends on the number and scope of kiosks	MEDIUM – up to 6% modal shift*	BEST
<ul style="list-style-type: none"> All bus/shuttle transit stops should be clearly marked on the pavement, and should include either bus bulbs or bus pull-outs if requested by the transit operators. 	LOW – if costs are built-in to project	BASIC – up to a 4% modal shift*	BETTER
<ul style="list-style-type: none"> Transit priority signals should be installed on critical site entrance/exit routes. 	HIGH – depending on number of signals	HIGH – up to 15% modal shift*	FAIR
Site Design Elements			

<ul style="list-style-type: none"> The development should be planned with a pedestrian and bicycle-oriented orientation. 	LOW – cost built-in to project	HIGH – up to a 7% modal shift*	BEST
<ul style="list-style-type: none"> Appropriate “traffic calming” devices should be employed throughout the site, including – curb extensions, raised crosswalks, tight corner radii, street trees, narrow lanes, bike lanes, etc. 	MEDIUM	MEDIUM – up to a 4% modal shift*	BETTER
<ul style="list-style-type: none"> All deliveries to the retail uses should be scheduled to avoid peak commute periods. 	Negligible	MARGINAL – no appreciable modal shift	FAIR
Additional Elements and Implementation Strategies			
<ul style="list-style-type: none"> Financial incentives should be provided to employees for them to not drive. 	\$360-600 per employee annually	HIGH – up to a 25% modal shift*	BETTER
<ul style="list-style-type: none"> A TDM committee could be formed to allow employees to be involved with setting TDM goals and developing programs. 	Negligible	BASIC – up to a 5% modal shift*	BETTER
<ul style="list-style-type: none"> Surveys of employers and employees should be conducted on a regular basis (annually) to document TDM effectiveness and to develop additional program measures. 	up to \$30,000	BASIC – up to a 5% modal shift*	FAIR

Source: DMJM Harris, 2008; *TDM Overview and TDM Strategies for Implementation*, City of Boulder, Colorado.